PATENT SPECIFICATION

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Inventor: FROMUT VOLLHARDT

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COMPLETE SPECIFICATION

Glass Furnace with Apparatus for Cooling the Melting Tank by means of a Cooling Liquid

We, SCHMIDT'SCHE HEISSDAMPF-GESELLSCHAFT M.B.H., of 273 Wilhelmshöher-Allee, Kassel-Wilhelmshohe, Germany, a German Body Corporate, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a glass furnace with apparatus for cooling the melting tank by means of a cooling liquid.

The furnace chamber and the melting tank of a glass furnace are generally made of refractory masonry or brickwork, the furnace chamber roof being formed as an arch. The masonry or brickwork used, more particularly that of the melting tank, is subjected to more or less rapid wear. As a result, it is necessary from time to time to renew the masonry or brickwork when it becomes defective. But in addition to the difficult and costly lining work involved, the necessary relining operation results in stopping the operation of the furnace for rather a long time, and in complete cessation of production during this time.

The invention consists in this, that the frame for the roof and side walls of the furnace chamber and for the bottom and side walls of the melting tank containing the molten metal is formed by cooling tubes which can be arranged so that they form level cooling tube walls fitted close together or cooling tube grids arranged at a distance from each other, which tubes start from a collector or manifold arranged under the bottom of the melting tank and open into a collector or manifold mounted centrally above the roof of the melting tank.

To form a jointless tank lining, in the region of the melting tank part containing the molten material a layer of refractory material which is initially plastic and subsequently hardens is applied to the part of the tube frame forming the bottom and side walls. The effective cooling surface formed by the cooling tubes in the region of the melting tank, and the thickness of the tank liniug, are suitably adjusted so that in operation this tank lining becomes coated with a solidified glass melt layer from the liquid glass metal of the tank charge.

The solidified glass melt layer from the liquid glass metal which is produced on the tank lining in this manner and which forms an impervious coating on the lining, constitutes a protective layer which resists all wear and repeatedly renews itself from the liquid glass metal, and which not only prevents the refractory tank lining applied to the cooling tubes from becoming defective, but also completely seals the tank lining.

In the region of the furnace chamber above the glass tank, the cooling tubes are bent away outwards in conformity with the arch shape of the furnace chamber roof to permit sufficiently thick masonry or brickwork serving as radiation walls to be arranged there. For securing the masonry or brickwork of the furnace chamber to the cooling tubes and for firmly anchoring the material forming the tank lining to said tubes, the latter are provided with lugs or the like. It is also advantageous to cover the cooling tubes in the furnace chamber with a suitably thick layer of fireclay, instead of masonry or brickwork, to form the radiation walls.

In order to permit profitable use to be made of the heat removed by the cooling tube system, the collectors or manifolds with which the cooling tubes of the cooling tube frame communicate are connected to a steam and condensate drum by risers and downcomers, or the cooling tube frame is connected to the water circuit of a waste heat boiler associated with the glass furnace, in order to increase its steam output. For forming burner apertures and gas discharge apertures in the side walls of the furnace chamber, the cooling tubes are suitably bent away from one another, or else these aper-

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tures are formed by being bounded at the top and at the bottom by pipe members forming collectors or manifolds, into which the tubes adjacent to the aperture region open.

An embodiment of the invention chosen by way of example is illustrated in the accompanying drawings, in which:

Fig. 1 is a cross section through the glass furnace, and

Fig. 2 is a portion of the melting tank wall formed by the cooling tubes, on a larger scale in section on a plane at right angles to that of Fig. 1.

The cooling tubes 1 form the frame for the glass furnace 2. The cooling tubes 1 start from a collector or manifold 4 arranged under the bottom of the melting tank 3 and open into a collector or manifold 7 mounted above the roof 5 of the furnace chamber 6. The cooling tubes 1 are so arranged that they form level cooking tube walls fitted close together or cooling tube grids arranged at a distance from each other and formed in accordance with the required shape of the roof 5 and of the side walls 8 of the furnace chamber 6, and of the side walls 9 and bottom 10 of the melting tank 3. To form a jointless tank lining, a layer 12 of a refractory material that is initially plastic and subsequently hardens is applied to the bottom 10 and the side walls 9 of the part of the tube frame forming the melting tank 3. The effective cooling surface formed by the cooling tubes 1 in the region of the melting tank 3, and the thickness of the layer 12, are so adjusted in regard to their dimensions that the layer 12 becomes coated with a protective layer formed by a sufficiently thick solidified glass melt layer 13 from the liquid glass metal 14 of the tank charge. The cooling tubes 1 are provided with lugs 15 which serve to anchor the layer 12 of the melting tank 3 and to secure the masonry or brickwork of the furnace chamber 6 to the cooling tubes 1. In the region of the furnace chamber 6 above the melting tank 3 the cooling tubes 1 are bent away outwards far enough to permit sufficiently thick masonry or brickwork serving as a radiation wall to be arranged in front of the cooling tubes. These radiation walls can also be formed by covering the cooling tubes 1 with a suitably thick layer of fireclay.

To enable the waste heat from the cooling system of the glass furnace 2 to be used for producing steam, the collectors 7 and 4 with which all the cooling tubes communicate are connected by risers 16 and downcomers 17 to a steam and condensate drum 18, or else the collectors 4 and 7 and the cooling tube frame are connected to the water circuit of a separate waste heat boiler (not shown in the drawings) associated with the glass furnace 2. To form burner apertures 19 and gas discharge apertures 20 in the side walls 8 of the furnace chamber 6, the cooling tubes 1 are suitably bent away from one another, or the burner apertures 19 and the gas discharge apertures 20 are bounded at the top and at the bottom by pipe members 21 forming collectors or manifolds into which the cooling tubes 1 adjacent to the aperture region open.

WHAT WE CLAIM IS:—

1. A glass furnace with apparatus for cooling the melting tank by means of a cooling liquid, characterised in that the frame for the roof and side walls of the furnace chamber and for the bottom and side walls of the melting tank containing the molten material is formed by cooling tubes which can be so arranged that they form level cooling tube walls fitted close together or cooling tube grids arranged at a distance from each other, which tubes start from a collector or manifold arranged under the bottom of the melting tank and open into a collector or manifold mounted above the roof of the furnace chamber.

2. A glass furnace as claimed in Claim 1, characterised in that in order to form a jointless tank lining, in the region of the melting tank part containing the molten material a layer of refractory material that is initially plastic and subsequently hardens is applied to the part of the tube frame forming the bottom and the side walls.

3. A glass furnace as claimed in Claim 2, characterised in that the effective cooling surface formed by the cooling tubes, and the layer thickness of the tank lining, are so adjusted as regards their dimensions that in operation the tank lining becomes coated with a protective layer formed by a solidified glass melt layer from the liquid glass metal of the tank charge.

4. A glass furnace as claimed in any one of Claims 1 to 3, characterised in that in the region of the furnace chamber above the melting tank the cooling tubes are bent away outwards in a suitable manner to permit sufficiently thick masonry or brickwork serving as radiation walls to be arranged there.

5. A glass furnace as claimed in any one of Claims 2 to 4, characterised in that the cooling tubes are provided with lugs for firmly anchoring the material forming the tank lining, and for securing the masonry or brickwork of the furnace chamber.

6. A glass furnace as claimed in any one of Claims 1 to 5, characterised in that the cooling tubes are covered with a layer of fireclay to form the radiation walls in the furnace chamber.

7. A glass furnace as claimed in Claim 1, characterised in that the collectors with which all the cooling tubes of the cooling tube frame communicate are connected by risers and downcomers to a steam and con-

803,457 COMPLETE SPECIFICATION
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Fig. 1

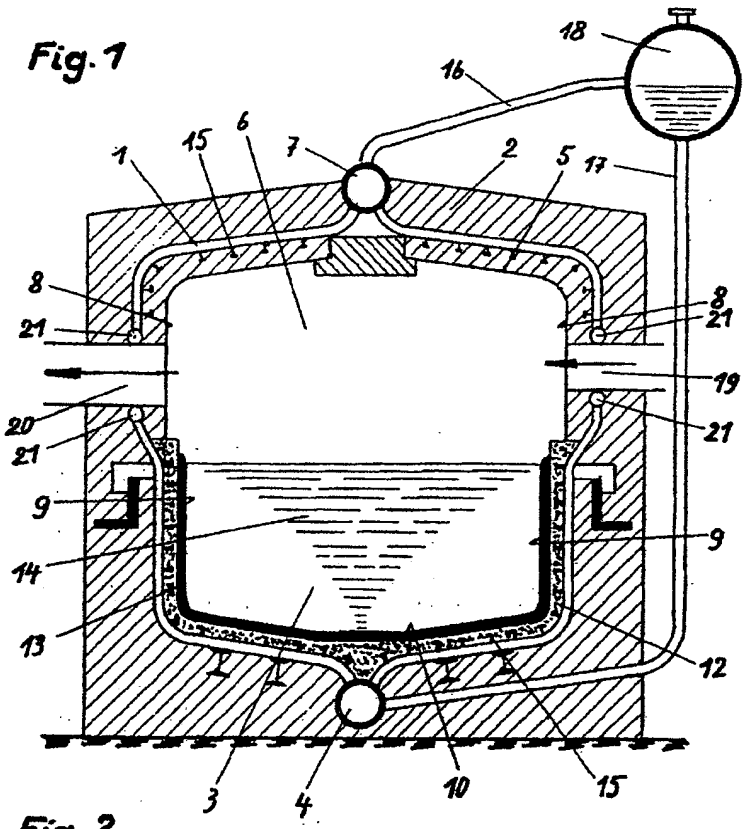

Fig. 2